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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/748,371

12/29/2003

Lu Zhen

ARC-P133

8167

32566 7590 05/20/2008

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EXAMINER

HUBER, JEREMIAH C

ART UNIT

PAPER NUMBER

2621

MAIL DATE

DELIVERY MODE

05/20/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/748,371	Applicant(s) ZHEN ET AL.	
	Examiner JEREMIAH C. HUBER	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,5,7 and 9-20 is/are pending in the application.
4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1,4,5,7 and 9-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 7, 9, 10, 12, 13, 15, 16, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pyramidal Implementation of the Lucas Kanade Feature Tracker Description of the Algorithm (hereafter Bouguet) in view of Clayton (20040017507) and in further view of Motion Compensated Image Interpolation (hereafter Cafforio).

In regard to claim 1 Bouguet discloses a method including:
generating first and second image pyramids comprised of a plurality of corresponding image levels of gradual resolution (Bouguet 2.1 note pg. 2 paragraph 3 note pyramidal representations of images I and J are composed of gradual resolutions e.g. 640x480, 320x24, 160x120 etc.);

warping a first image level of a first image pyramid with a motion field (Bouguet 2.1 for image pyramid and 2.3 particularly pg. 5 note B_k new translated image);
determining a residual motion field from the warped first level image of the first image pyramid and a corresponding first level image of the second image pyramid (Bouguet 2.3 particularly pg. 5 note residual v^k);

when an error value is not less than a threshold, adding the residual motion field to the motion field and repeating the above steps (Bouguet 2.3 particularly pg. 5 note eq. 31 adding residual motion v^k further computation continues until pixel is smaller than a threshold); and

when an error value less than the threshold performing the above steps using the second level image of the first and second image pyramids (Bouguet 2.2 particularly pg. 2 note results are propagated from deeper to upper levels).

It is noted that Bouguet discloses comparing a pixel error to a threshold rather than a residual motion vector. However, Clayton discloses a motion compensation method wherein a residual motion is compared to a threshold as a test to stop an iterative process (Clayton par. 130 note iteration causes a change in motion vector to be less than a threshold). It is therefore considered obvious that one of ordinary skill in the art would recognize the advantage of include a residual motion vector threshold as taught by Clayton in the invention of Bouguet in order to reduce computation time incurred by computing pixel errors.

It is further noted that neither Bouguet nor Clayton disclose generation of an intermediate image on a pixel by pixel basis. However, Cafforio discloses a method for motion compensated interpolation in which an intermediate image is generated between first and second images on a pixel by pixel bases using a motion field (Cafforio Section IV note part A motion field estimated on a pixel by pixel basis and part B for two methods of generating an intermediate image also note Figs. 8-9). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would

recognize the advantage of including intermediate image generation as taught by Cafforio in the invention of Bouguet in view of Clayton in order to interpolate missing images.

In regard to claim 7 refer to the statements made in the rejection of claim 1 above. Cafforio further discloses selecting first and second pixels paired by a motion vector and determining a position of a pixel in the intermediate image on a recurring pixel by pixel basis (Cafforio sect. IV B note first method in first two paragraphs motion field is used to find corresponding pixels on a pixel by pixel basis and determine the position of the pixel in the intermediate frames using a fraction of displacement). It is noted that Cafforio does not explicitly state a value that is determined for the interpolated pixel. However, it is inherent to the function of generating frames for a value to be assigned to every frame pixel. Further, Cafforio implies that the value given to the interpolated pixel is the value of the first or second pixel (Cafforio Sect IV B paragraph 1 note position of the corresponding points in the missing frame).

In regard to claim 9 refer to the statements made in the rejection of claim 1 above. Bouguet further discloses:
providing a first second image pyramids associated with first and second frames comprised of a plurality of corresponding image levels of gradual resolution (Bouguet 2.1 note pg. 2 paragraph 3 note pyramidal representations of images I and J are composed of gradual resolutions e.g. 640x480, 320x24, 160x120 etc.);
computing a motion field comprising a plurality of motion vectors that respectively associate each pixel in the first image with a corresponding pixel in the second image,

wherein the motion field is computed recursively through the image levels from a coarsest resolution to the finest (Bouguet 2.2 and 2.3 note 2.2 on pg. 2 feature tracking establishes a displacement vector for each pixel, also note optical flow is computed from the deepest or coarsest level to the upper or finest levels)

In regard to claim 10 refer to the statements made in the rejection of claims 1 and 9 above. Bouguet further discloses performing a computation loop to derive a motion field based on for a current level based on a motion field of a coarser level wherein the previous motion field is initially assigned to the current motion field (Bouguet 2.2 and 2.3 note pg. 2 results are propagated to a next lower level as an initial guess).

In regard to claim 12 refer to the statements made in the rejection of claim 10 above. Bouguet further discloses that the motion field is obtained by applying the computation loop to the finest level (Bouguet 2.2 pg. 2 note optical flow is refined up to the level of the original image).

In regard to claims 13, 15, 16, 18 and 20 refer to the statements made in the rejection of claims 1, 7, 9, 10 and 12 above.

Claims 4, 14 and 17 rejected under 35 U.S.C. 103(a) as being unpatentable over Bouguet in view of Clayton and further in view of Cafforio and The Laplacian Pyramid as a Compact Image Code (hereafter Burt).

In regard to claims 4, 14 and 17 refer to the statements made in the rejection of claims 1, 9 and 16 above. Bouguet further discloses filtering of images during generation (Bouguet 2.1 pg. 2). It is noted that neither Bouguet, Clayton nor Cafforio disclose

generating Laplacian pyramids. However, at the time of the invention the use of Laplacian image pyramids was common and notoriously well known in the art as is evidenced by Burt (Burt note Laplacian Pyramid pgs. 535-537). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage of utilizing Laplacian Pyramids in the invention of Bouguet in view of Clayton and in further view of Cafforio as was well known in the art in order to enhance image features as suggested by Burt (Burt pg. 535 col. 2).

Claims 5, 11 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Bouguet in view of Clayton and further in view of Cafforio and Determining Optical Flow (hereafter Horn).

In regard to claims 5, 11 and 19 refer to the statements made in the rejection of claims 1, 10 and 18 above. It is noted that neither Bouguet, Clayton nor Cafforio disclose use of a Horn and Schunk motion estimation algorithm. However, at the time of the invention use of the Horn and Schunk motion algorithm was common and notoriously well known in the art as is evidence by Horn (Horn pgs. 1-14 describe the Horn and Schunk algorithm). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage of utilizing the Horn and Schunk algorithm in the invention of Bouguet in view of Clayton and in further view of Cafforio in order to have a robust estimation of motion as suggested by Horn (Horn Abstract).

Response to Arguments

Applicant's arguments with respect to claims 1, 4, 5 and 7 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeremiah C. Huber whose telephone number is (571)272-5248. The examiner can normally be reached on Mon-Fri 8:00 a.m. - 4:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571)272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeremiah C Huber/

Examiner, Art Unit 2621

/Mehrdad Dastouri/

Supervisory Patent Examiner, Art Unit 2621